





# Wastewater Treatment Control Systems

"*Hydromantis is committed to the provision of process engineering and computer-based technologies for wastewater treatment plant design, operation and control. As process engineers and the developers and licensers of GPS-X (a modelling tool), Hydromantis has developed an impressive list of municipal and industrial clients in wastewater treatment operation. Our goal, through this project, is to remain on the cutting edge of technology, and to provide our clients with the full benefit of our process engineering strength.*"

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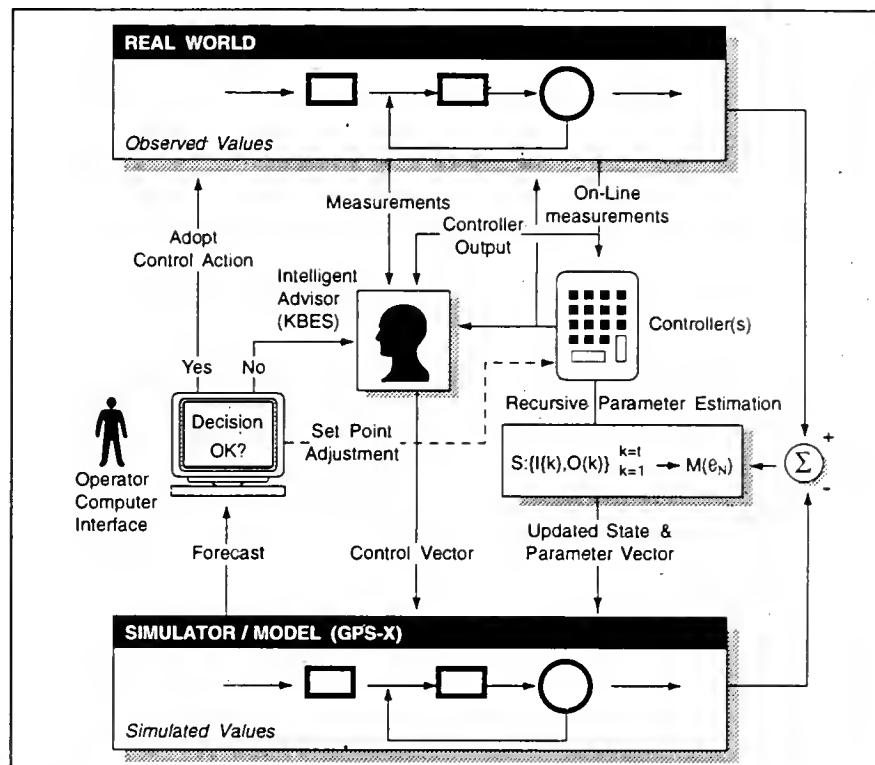
## THE COMPANY

Hydromantis is a Canadian environmental engineering consulting company which specializes in the development and application of process engineering as well as in new and innovative computer-based technologies in water and wastewater engineering. Hydromantis is recognized as a leader in the modelling and simulation of wastewater treatment plants.

## THE CHALLENGE

Today, municipal and industrial wastewater treatment plants must meet increasingly stringent standards for effluent. But wastewater treatment plants are complex and the amount and quality of the sewage varies. If they are to operate at peak performance then they need advanced and automated controls for the treatment processes.

Hydromantis, with the support of the Ministry of the Environment developed a computer-based control system called the Integrated Computer Control System or IC<sup>2</sup>S. The IC<sup>2</sup>S is designed to improve the performance of the plant which, in turn, will decrease the variations in the quality of the effluent and help to defer



An integrated approach to wastewater treatment plant operation and control

the capital cost expenditure for upgrading or expanding the plant. Further, the IC<sup>2</sup>S will help to reduce:

- \* the number of violations for effluent quality;
- \* the volume of pollutants loaded into the receiving waters;
- \* energy costs by lowering the amount of energy used.

## TECHNOLOGY DESCRIPTION

The IC<sup>2</sup>S consists of a collection of computer modules which build on a plant's existing control systems. These include the automatic sampling instruments, closed-loop automatic units and supervisory control and data acquisition (SCADA) systems. The IC<sup>2</sup>S is an automated control system which identifies changes in the characteristics of the wastewater as it goes through the treatment process. The aim is to predict and avert upsets

in the process before they happen. These modules include:

- \* **Adaptive Data Filtering (ADF)** – It extracts data from the on-line sensors in the plant, filters out the factors which might interfere with a true reading of the data and gives the real measurements;
- \* **Respirometric Parameter Identification (RPI)** – It continuously monitors the activated sludge process using respirometry data. Respirometry measures the rate at which oxygen is consumed by micro-organisms during the oxidation of organic matter.
- \* **Dynamic Parameter Estimator** – It automatically estimates parameters that may change with time. By using this estimator, the calibration of the model can be updated constantly.

\* ***Simulation Model (General Purpose Simulator or GPS-X)*** – It is a computation tool for developing and calibrating models which simulate the workings of wastewater treatment plants.

\* ***Decision Support System (DSS)*** –

It uses current plant conditions from on-line and off-line, or stored data, as well as simulated results to find abnormalities in the process and to suggest ways to control them.

\* ***Advanced Automatic Control (AAC)*** –

It uses the interface of the GPS-X simulator and MATLAB – a powerful numerical problem solver – to create advanced controls that allow for the dynamic nature of wastewater treatment process models.

\* ***Human Computer Interface (HCI)*** –

It provides a link between the operator and the IC<sup>2</sup>S functions.

## RESULTS

Testing during the present IC<sup>2</sup>S projects shows that the IC<sup>2</sup>S modules keep a simulated plant in compliance and working efficiently. Further, Hydromantis has developed module functions to identify trends in data, to use respirometry derived information, to estimate parameters which vary over time and to identify and establish control systems for the plant's processes. Finally, the company has used a simulator to provide new insight into a plant's operations, to predict future trends and to test different options for controlling the quality of the effluent.

In the future, Hydromantis will demonstrate the IC<sup>2</sup>S using a full-scale plant model in GPS-X and data from wastewater treatment plants in Ontario.

## TECHNOLOGY OPPORTUNITIES

The IC<sup>2</sup>S technology helped the company to land a consulting contract for an engineering project in the south west United States. In addition, some modules of IC<sup>2</sup>S have been included as add-ons to the GPS-X software.

## PARTNERSHIP IN POLLUTION PREVENTION AND RESOURCE CONSERVATION

The demonstration of this technology was partially supported by the Ontario Ministry of the Environment. The development of the respirometry part of the project was led by a research team at the University of Ottawa.

Industrial companies located in Ontario may seek ministry/industry services which will help them:

- \* reduce, reuse and recycle solid waste;
- \* effectively remediate historic pollution;
- \* destroy hazardous contaminants;
- \* reduce or eliminate liquid effluent and gaseous emissions;
- \* use energy and water more efficiently.

Equipment and services supply companies can benefit from the information provided on technologies identified for business development.

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## MINISTRY OF THE ENVIRONMENT SERVICES

For information on Ministry of the Environment assistance to industry, please contact the Industry Conservation Branch at (416) 327-1492, Fax (416) 327-1261.

For more project profiles and other publications, visit the ministry's website at <http://www.ene.gov.on.ca>

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